it covered the coastal waters of the United States from Oregon to Lower California and the major part of the ocean otherwise between the fifteenth and thirtieth parallels.

The following table gives barometric data for several island and coast stations in west longitudes, including Point Barrow on the Arctic Ocean:

TABLE 1.—*Averages, departures, and extremes of atmospheric pressure at sea level at indicated hours, North Pacific Ocean and adjacent waters, January, 1931*

Stations	Average pressure	Departure from normal	Highest	Date	Lowest	Date
	Inches	*Inch*	*Inches*		*Inches*	
Point Barrow [1]	30.06	−0.02	30.72	21st	29.60	8th.
Dutch Harbor [1]	28.94	−0.64	29.68	4th	28.22	6th.
St. Paul [1]	29.07	−0.56	29.76	4th	28.44	7th.
Kodiak [1]	29.11	−0.48	29.60	17th	28.66	14th.
Midway Island [1]	29.99	−0.04	30.26	10th [3]	29.64	25th.
Honolulu [2]	30.07	+0.07	30.26	1st	29.88	26th.
Juneau [2]	29.62	−0.26	30.26	17th	28.97	4th.
Tatoosh Island [2] [4]	29.94	0.00	30.48	17th	29.33	22d.
San Francisco [2] [4]	30.12	+0.03	30.32	16th	29.75	7th.
San Diego [2] [4]	30.07	+0.01	30.32	4th	29.80	6th.

[1] Averages from p. m. observations only.
[2] A. m. and p. m. observations.
[3] And on the 11th.
[4] Corrected to 24-hour mean.

NOTE.—Beginning with January, 1931, new normals of atmospheric pressure are in use for Midway Island and the Alaskan substations appearing in this table. For Dutch Harbor, St. Paul, Kodiak, and Midway Island the average covers a period of 12 years and for Point Barrow 8 years. Data are compiled to include the year 1928.

January, 1931, was peculiarly a stormy month on the North Pacific Ocean and no day passed without gales in some portion of the sea, although they were generally well distributed over all the region from the thirtieth parallel northward. According to reports already received wind forces of 11 to 12 occurred on at least 10 days of the month, and forces of 10—whole gales—on more than half the days, in many cases blowing simultaneously in connection with widely separated disturbances. The tabular statement—Ocean gales and storms—presents a picture of the general storminess, showing gales of force 9 and upward, which needs no fuller amplification in text.

Several of the important local gales of major storm force were associated with the activities of the Aleutian LOW; some were due to the sharp expansion of the cyclone region against the immediately outlying anticyclone, which resulted in the formation of sudden steep barometric gradients, while others accompanied the more powerful of the progressive cyclones.

The severest cyclone of the month originated south of Japan on the 1st or 2d and began moving rapidly northeastward. By the 3d, then central at some distance southeast of the Kuril Islands, it attained hurricane intensity. On the 4th, south of the central Aleutians, it was causing dangerous gales over a great region along the upper routes between 160° E. and 170° W. On the 5th and 6th, now of great depth and continuing high wind intensity, it crossed the eastern Aleutians. The following three days witnessed its rapid decadence as it contracted in area and wandered aimlessly over the eastern waters of the Bering Sea. This storm was remarkable for its extremely low central pressure during the 4th and 5th, corrected barometer readings from the American steamer *President Grant* running below 28 inches for several hours, the minimum being 27.78, in 50° 13′ N., 173° 41′ W., on the 5th.

On the 5th, also, on the eastern extremity of the general Aleutian disturbance, hurricane velocities from the northwest occurred off the Washington coast near North Head, and strong to storm gales, mostly southerly, were encountered off this and the Oregon coast on the 21st, 22d, and 25th. A maximum velocity of 67 miles an hour from the south was recorded on the 22d at the Weather Bureau station on Tatoosh Island.

Midway along the sailing routes between the United States and Honolulu gales of force 8 to 10 occurred on 8 or more days, this region being unusually stormy. The period of most prolonged storminess here was from the 23d to 27th.

As indicative of the unusually long-sustained southward extension of the storm area for January this year, it is necessary only to remark that gales of force 8 to 10 occurred at various times and in various longitudes on about half the days of the month even in as low a latitude as that of the thirtieth parallel, a fact that, in the opinion of the writer, can not be duplicated by any other month of record.

In the China Sea one typhoon—the only North Pacific tropical cyclone of the month—was a brief disturbing weather factor. This is treated in the subjoined article. The northeast monsoon, however, blew at times with fresh gale force on several days, particularly on the 10th to 16th west of the Philippine Islands.

In and near the Gulf of Tehuantepec northers of gale force—8 to 10—were unusually frequent, occurring on at least 12 days of the month.

Strong northeast trades, rising to moderate gale force, were reported by the American steamer *Sierra* between 1° and 15° north latitude south of the Hawaiian Islands on the 13th to 15th.

At Honolulu the wind was generally light with prevalence from the east. The maximum velocity was 24 miles an hour from the northeast on the 18th.

Fog was rarely encountered on the Pacific this month except along or at no great distance from the coasts. Vessels up to time of this writing (March 2) have reported fog off the China coast on 6 days and in American waters between Vancouver and San Diego on 11 days.

TYPHOONS AND DEPRESSIONS

FIRST DESTRUCTIVE TYPHOON OVER THE PHILIPPINES IN 1931, JANUARY 3 AND 4

By REV. JOSÉ CORONAS, S. J.

[Weather Bureau, Manila, P. I.]

The Philippines have been visited at the beginning of this year by a very destructive typhoon, more severe than any of the typhoons experienced in our archipelago during the past year, 1930. Taking into consideration the Provinces most affected by this typhoon, it can be compared with that of October 15, 1912, although it was not so deep and of much less extension. Yet great damage was done to the crops and to the public and private properties, thousands of people remained homeless, besides a considerable loss of life that has been reported from several Provinces.

The typhoon was probably formed on December 30, 1930, nearly 300 miles to the south of Guam in about 145° longitude E. and 9° latitude N. It moved W. by N. and passed near to the north of Yap at 11 p. m. of December 31 when a barometric minimum of 749 mm. (29.49 ins.) was recorded with winds from W., force 5. From 2 to 10 p. m. of January 2 the typhoon took a WSW. direction: hence instead of entering the Philippines through the southern part of Samar, as it could be anticipated, it

came to pass through the Surigao Strait between Surigao and the southern coast of Samar. After 10 p. m. of the 2d the typhoon moved again to WNW. and W. by N. toward the central part of Leyte and the northern part of Cebu and Panay Islands. From Panay the typhoon moved northwest toward the southern coast of Mindoro and then into the China Sea, when it gradually filled up on the 5th or 6th in the neighborhood of the Paracels.

The barometric minimum reported from our stations was that of Dumalag, Capiz, 737 mm. (29.02 ins.) with winds veering from NW. to N., NE., E., and S. Relative calm was observed at Tuburan, Cebu, between 8.30 and 8.40 a. m. of the 3d.

The rate of progress of this typhoon was far from being uniform; because while from 2 to 6 a. m. of the 3d it moved at the heavy rate of about 20 miles per hour, from 6 a. m. to 2 p. m. of the same day the rate was slightly over 11 miles per hour.

The approximate positions of the center of this typhoon from December 31 to January 5 were as follows:

December 31, 6 a. m., 142° 20′ longitude E., 9° 20′ latitude N.
December 31, 11 p. m., 138° 15′ longitude E., 9° 50′ latitude N.
January 1, 6 a. m., 135° 45′ longitude E., 10° 10′ latitude N.
January 2, 6 a. m., 130° 45′ longitude E., 10° 40′ latitude N.
January 2, 10 p. m., 126° 25′ longitude E., 10° 10′ latitude N.
January 3, 2 a. m., 125° 40′ longitude E., 10° 25′ latitude N.
January 3, 6 a. m., 124° 20′ longitude E., 10° 50′ latitude N.
January 3, 2 p. m., 122° 50′ longitude E., 11° 10′ latitude N.
January 4, 6 a. m., 120° 40′ longitude E., 12° 25′ latitude N.
January 5, 6 a. m., 116° 50′ longitude E., 15° 30′ latitude N.

BUCKET OBSERVATIONS OF SEA-SURFACE TEMPERATURES

By GILES SLOCUM

STRAITS OF FLORIDA AND CARIBBEAN SEA

With the January, 1931, issue of the MONTHLY WEATHER REVIEW is initiated the monthly publication of a summary of Greenwich mean noon "Bucket observations" of temperatures at the surface of the water for the month one year preceding the date borne by the issue, in the Straits of Florida and the Caribbean Sea.

The "Caribbean Sea" is here defined as the area included between the American Continents on the south and west and the Greater Antilles and outermost Lesser Antilles on the north and east. The entire Mona Passage, the Windward Channel south of 20° N., and the Yucatan Channel north to 22° N., west on this parallel to 87° W., and south to the Yucatan Peninsula, are included, but observations from Lake Maracaibo are omitted.

The "Straits of Florida" data refer to the area bounded on the east by the eightieth meridian, on the north by the twenty-fifth parallel, on the west by the eighty-fourth meridian, and on the south by the Cuban coast.

As is well known, the method of taking bucket observations consists of drawing up with a canvas bucket thrown over the side of the ship a sample of the water near the surface. The temperature of this sample is immediately taken with a mercurial thermometer and recorded on the proper form. In a small but unknown number of cases other methods, such as measurement of the temperature at the condenser intake, are used by the mariners.

The variation of weather conditions from day to day have modifying effects on the temperatures of the water surface and, while the number of measurements of these temperatures within a stated area in any one day is, to a considerable degree, due to elements of chance, and subject to wide fluctuations. The truest mean temperature, then, will not result from weighting equally either the individual observations or those collectively of the single days, and a longer unit-period of time is needed.

The month, therefore, has been divided into four nearly equal "Quarters," each quarter embracing a period of either seven or eight days, as shown in Table 1. The mean of the averages of the four quarters is adopted as the mean temperature for the area during the month.

This gives a uniform method of computing the means for months of unequal length. The quarter-month is a period short enough to practically exclude, in tropical and subtropical latitudes, any seasonal march between its beginning and its end, but is yet long enough to smooth out daily chance fluctuations in the number of observations taken, and to make their number within each period of the same order of magnitude, justifying the assigning of roughly equal weights to them.

In computing the means for each 5-degree square in the Caribbean, however, the use of this refinement is not possible, and the means used are the sums of the temperatures for the months divided by the numbers of observations.

From this, it is obvious than an even greater number of observations than is available would be highly desirable, and, lacking this greater number, it is important that no genuinely pertinent information be neglected to round out the data, but such observations as are taken in port are not used because of various factors affecting their direct comparability with those taken on the open seas.

On this basis, and subject to these limitations, Table 2 shows the mean temperature for the Caribbean Sea and the Straits of Florida for January of each year from 1919 to 1930, inclusive, and Table 3 summarizes the temperature for the month in the same area, including the departures of the January, 1930, means from the 11-year means for January (1920–1930), and the changes from the temperatures for the preceding month of December, 1929.

The means for 1919, it will be noted, are not used in the computations or comparisons, the poor distribution and dearth of data for that year making them somewhat unreliable.

The chart at the end of this article shows the number of observations taken during the month of January, 1930, within each 1° square; the mean temperatures of the Straits of Florida and of each 5°[1] square in the Caribbean Sea; the 11-year means (1920–1930), for these areas; and the local mean time corresponding to Greenwich mean noon, at which time the mariners are instructed to make the temperature readings.

TABLE 1.—*Lengths of "Quarter months" used in computing mean sea-surface temperatures*

Length of month	Days of month included in quarter			
	I	II	III	IV
28 days	1–7	8–14	15–21	22–28
29 days	1–7	8–14	15–21	22–29
30 days	1–7	8–15	16–22	23–30
31 days	1–7	8–15	16–23	24–31

[1] In three cases, indicated on the chart, the observations from small, little traveled, and unimportant areas have been treated as parts of the contiguous 5° squares.